Lecture Module - Introduction

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering

Tennessee Technological University

Topic 2 - Types of Variables

Topic 2 - Types of Variables

- Measured Variable
- Independent and Dependent Variables
- Controlled Variables and Parameters
- Extraneous Variables
- Engineering Examples

Measured Variable

"A measurement is an act of assigning a specific value to a physical variable. That physical variable is the measured variable."

Text: Theory and Design of Mech. Meas.

Independent and Dependent Variables

"If a change in one variable will not affect the value of some other variable, the two are considered independent of each other. A variable that can be changed independently of other variables is known as an independent variable. A variable that is affected by changes in one or more other variables is known as a dependent variable. Normally, the variable that we measure depends on the value of the variables that control the process."

Text: Theory and Design of Mech. Meas.

Controlled Variables and Parameters

"A variable is controlled if it can be held at a constant value or at some prescribed condition during a measurement... ...complete control of a variable is not usually possible. We use the adjective controlled to refer to a variable that can be held as prescribed, at least in a nominal sense...

...we define a parameter as a functional grouping of variables. For example, a moment of inertia or a Reynolds number... ...A parameter that has an effect on the behavior of the measured variable is called a control parameter...."

Text: Theory and Design of Mech. Meas.

Extraneous Variables

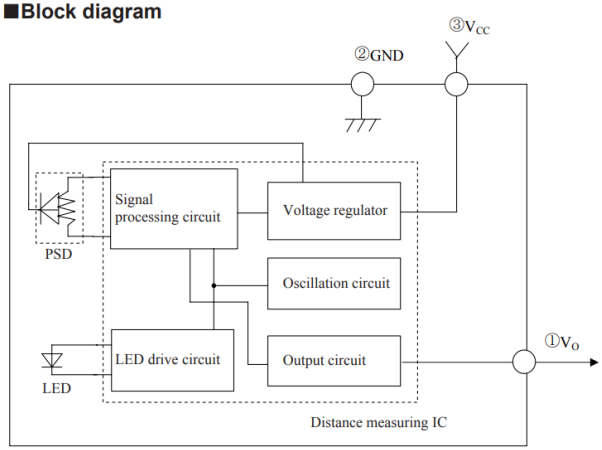
"Variables that are not or cannot be controlled during measurement but that affect the value of the variable measured are called extraneous variables. Their influence can confuse the clear relation between cause and effect in a measurement... ...The effects due to extraneous variables can take the form of signals superimposed onto the measured signal with such forms as noise and drift."

Text: Theory and Design of Mech. Meas.

Engineering Examples

Example 1: SHARP IR Ranger

■Block diagram



Identify the following measurement stages

- Sensor: _____
- Transducer: _____
- Signal Conditioning: _____
- Output: _____

Name at least one for each of the following categories

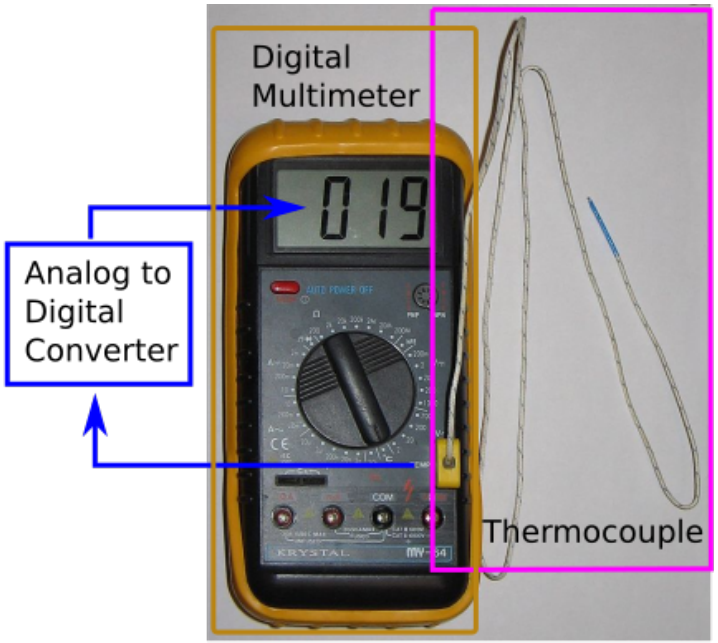
- Measured Variable: _____
- Independent Variable(s): _____
- Dependent Variable(s): _____, _____
- Controlled Variable(s): _____, _____
- Extraneous Variable(s): _____

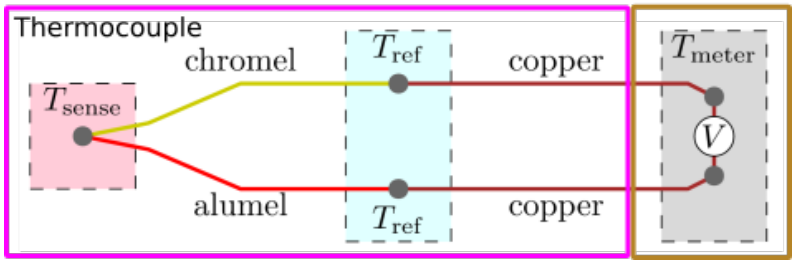
Image, More Info: Wikipedia

Image, More Info: Wikipedia

Engineering Examples

Example 2: Thermocouple with DMM





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- Extraneous Variable(s):_____